Science Informing California's Marine Life Protec Act

- Bioeconomic models

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Science Advisory Team
Marine Life Protection Act

Role of the Science Advisory Team

- Develop design guidelines for an effective network of MPAs
- Convey scientific basis of guidelines to other components of the process (stakeholders and taskforce)
- Evaluate proposals and how well they meet the guidelines

Spatial Bioeconomic Models to Evaluate Network Proposals

- Two models designed to assess the relative conservation and economic consequences of network proposals
- UC Davis: Botsford, White, others
  UC Santa Barbara: Costello, Hilborn, others
- Structurally similar, but slightly different approaches to modeling adult movement, overall level of fishing, other details
- Concordance in results inspire confidence that outcomes not sensitive to details of any one model

Spatial Bioeconomic Models
Model Inputs

Geographic

- Circulation patterns (ROMS: 1996-2002)
- Habitat maps (larval production and settlement)
- Proposed marine protected area (MPA) boundaries and regulations

Species life history traits

- Demography (growth, natural mortality, fecundity)
- Adult movement
- larval dispersal (pelagic larval duration, spawning season, some behavior)
- Egg-recruit or settler-recruit relationship (critical to population persistence)

Models of Population Sustainability

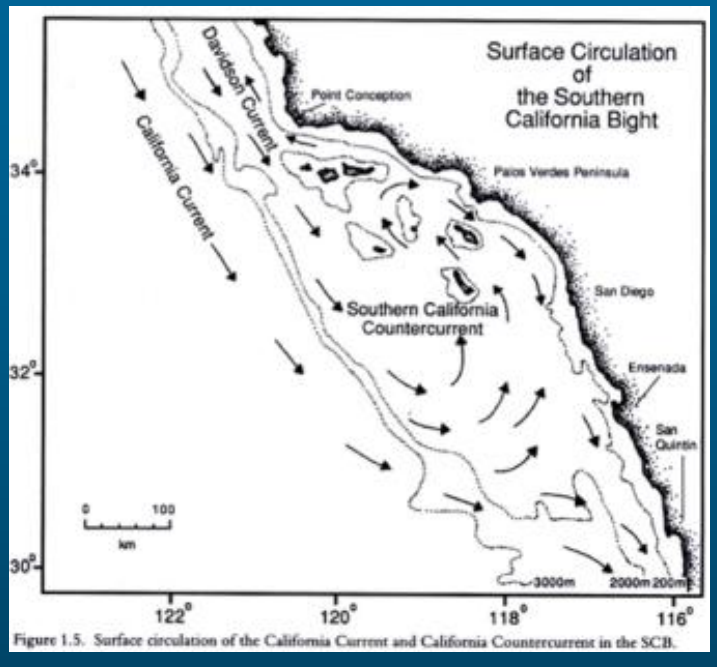
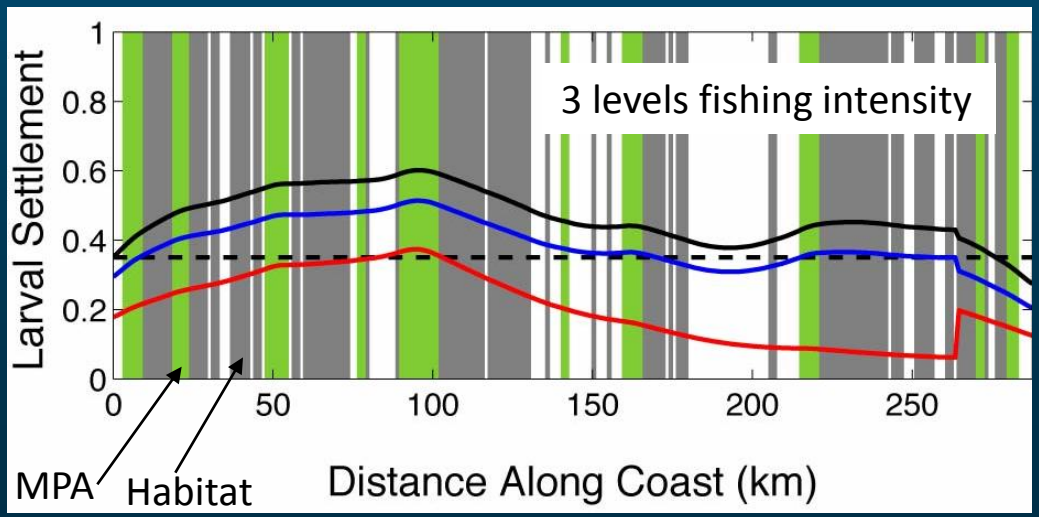
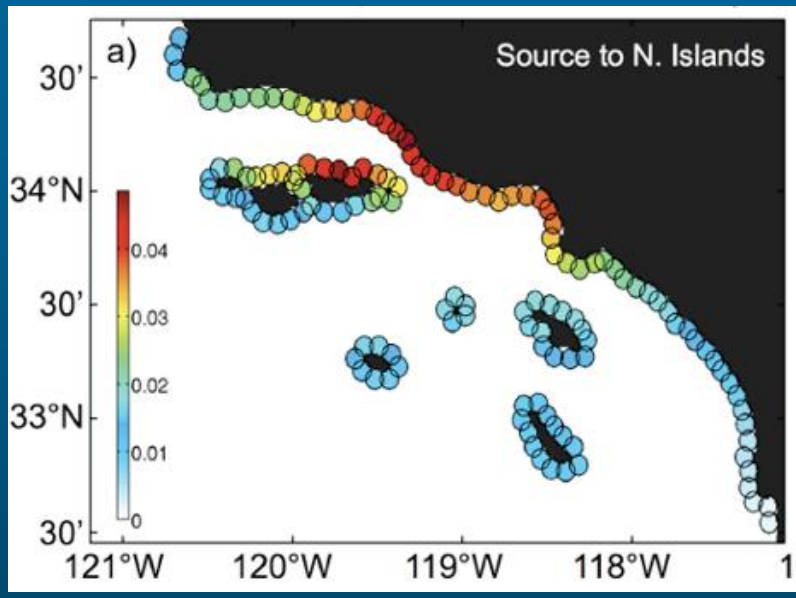
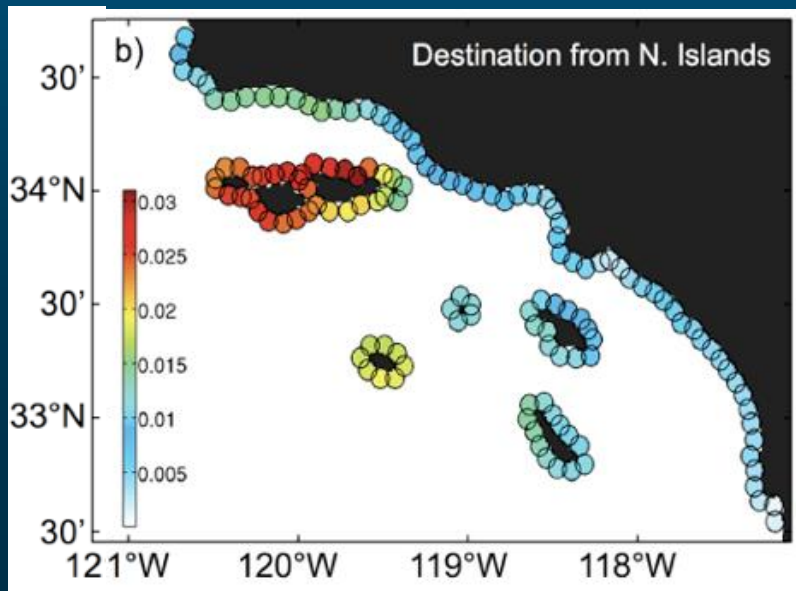
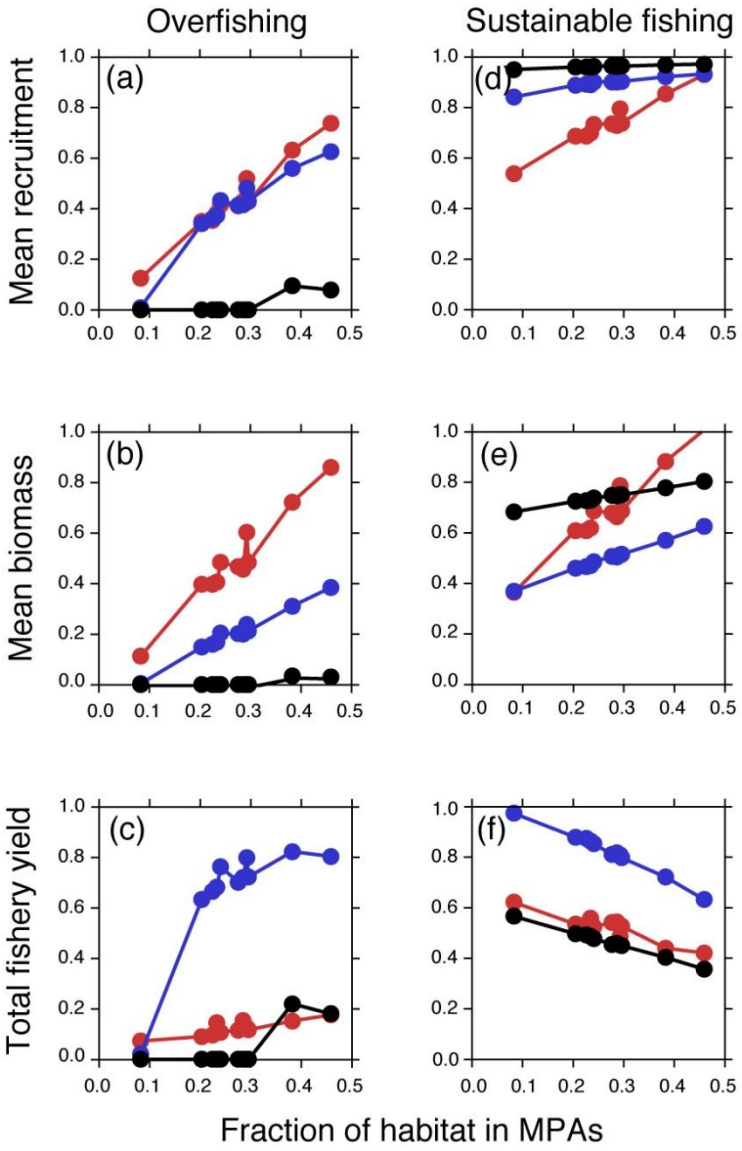


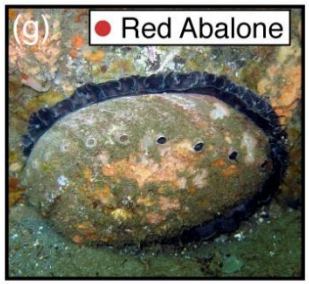
Figure 1.5. Surface circulation of the California Current and California Countercurrent in the SCB.



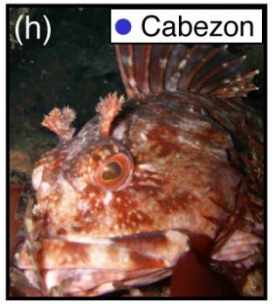




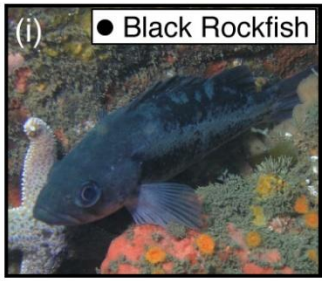




Red Abalone
- Small homerange
- Short larval dispersal



Cabezon
- Small homerange
- Long larval dispersal



Black Rockfish
- Large homerange
- Long larval dispersal

White et al. (2010) *Ecological Applications* in press

Spatial Bioeconomic Models
Model Outputs

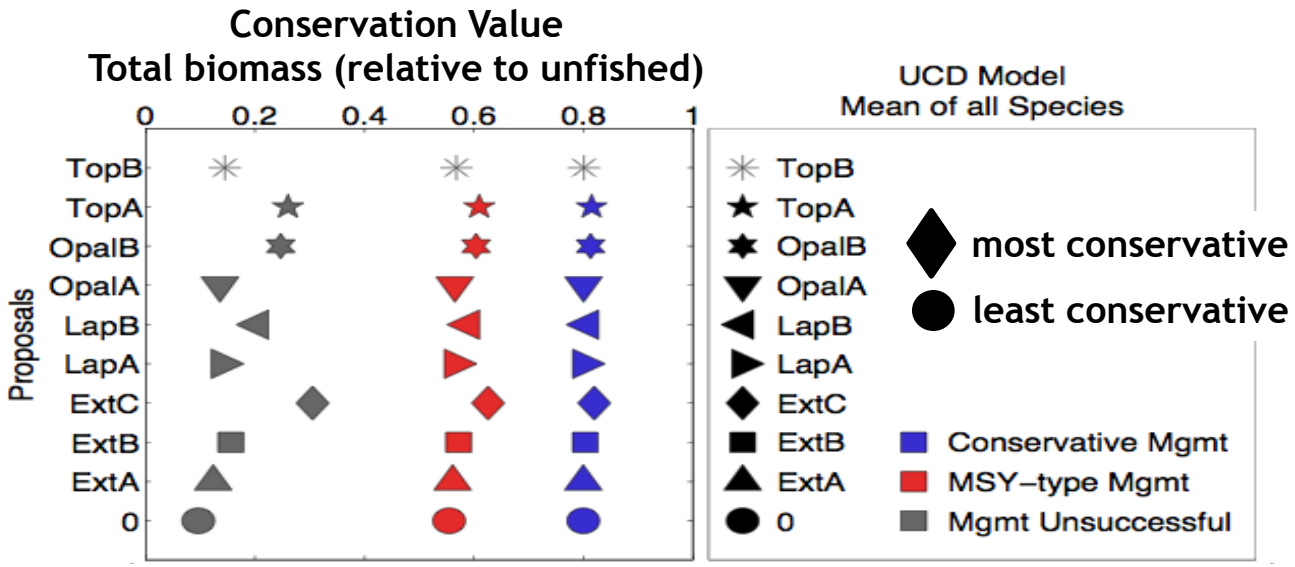
Conservation

- spatial distribution of larval settlement and biomass
- total settlement and biomass (summed over study region, weighted sum across species)

Economic

- spatial distribution of yield
- total yield and profit (summed over study region, weighted sum across species)

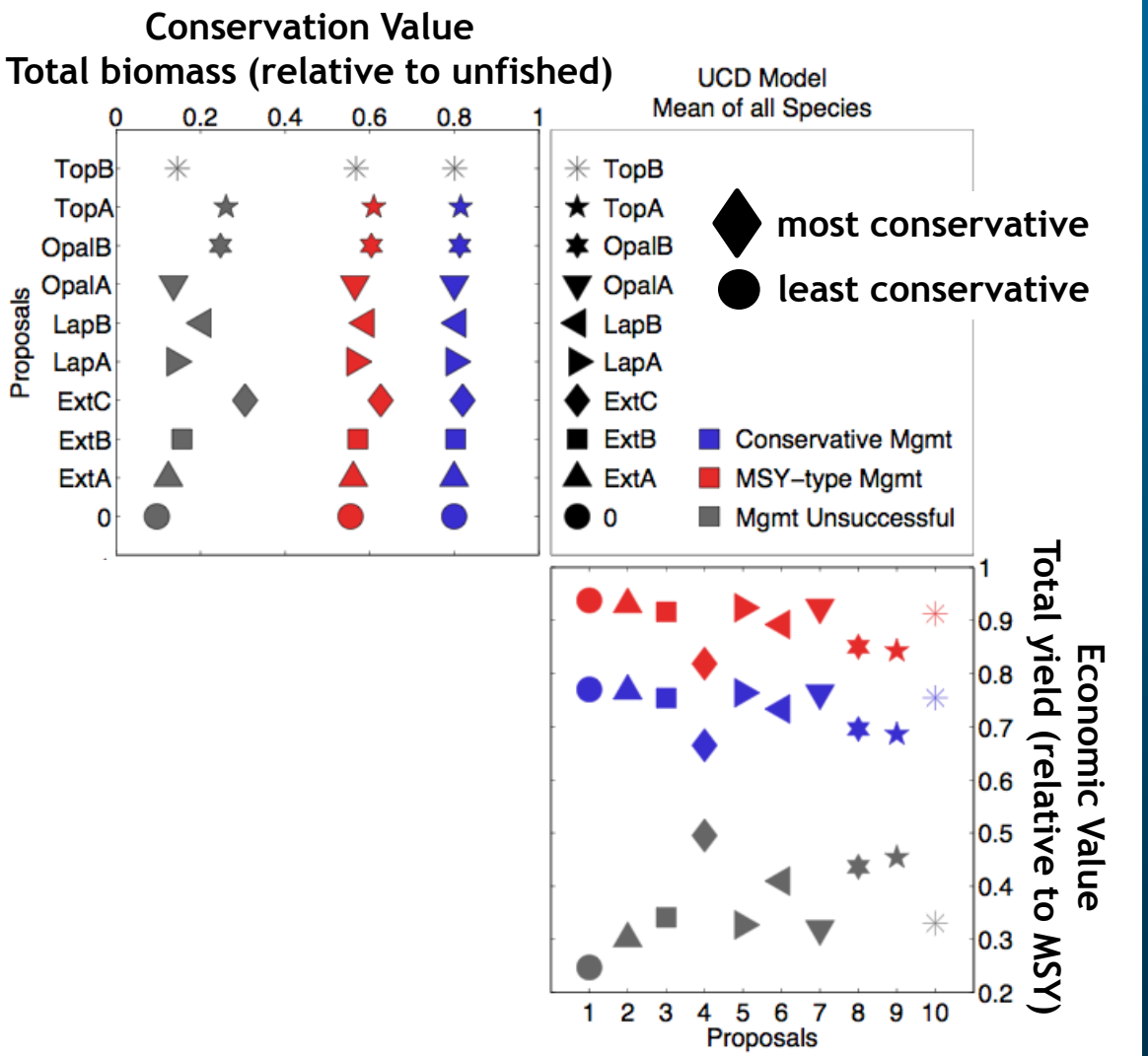
UCD Model Results: Biomass



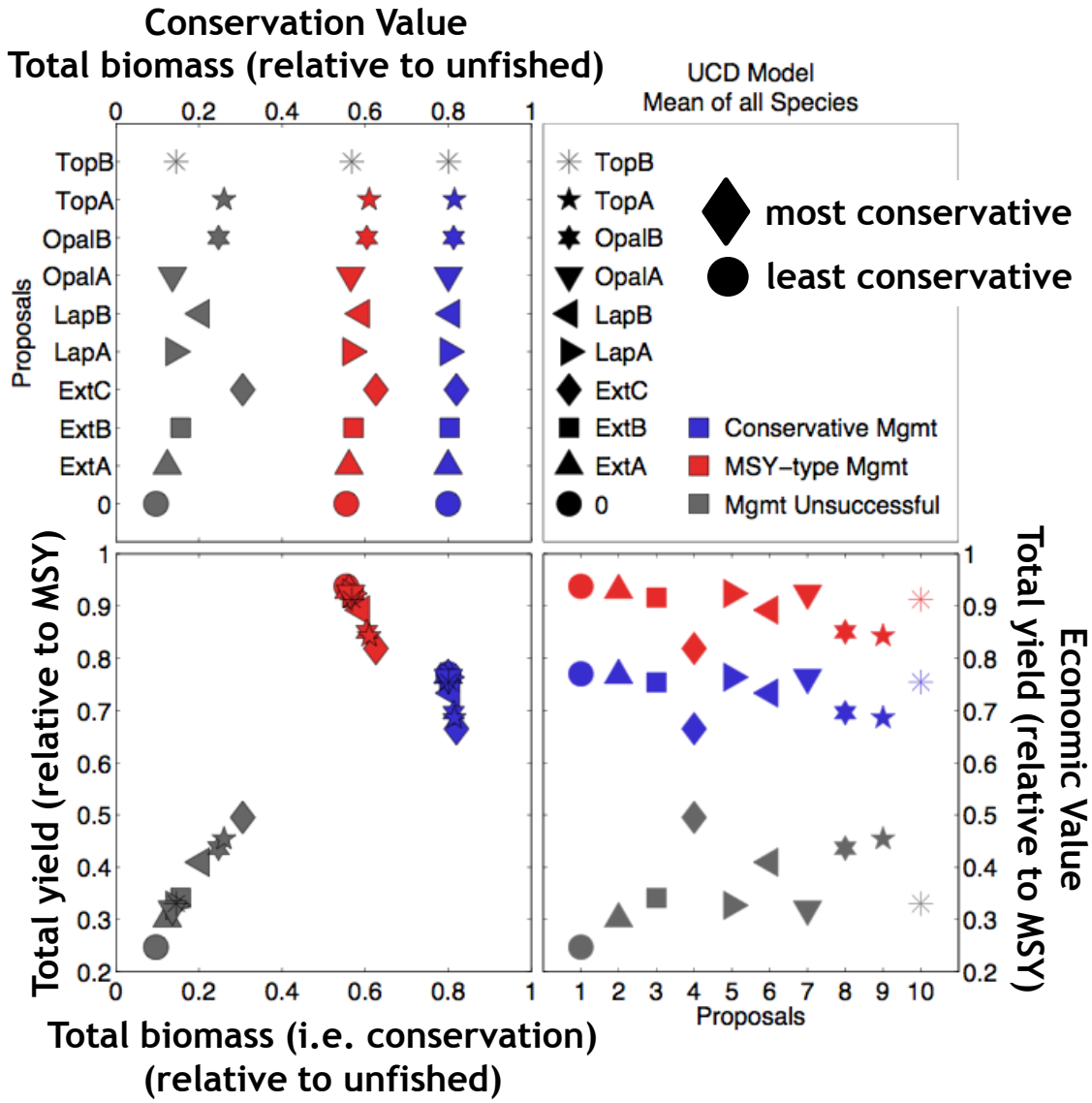
All outputs are region-wide long-term equilibria

Each output is calculated for a range of assumptions about future fishery management outside MPAs

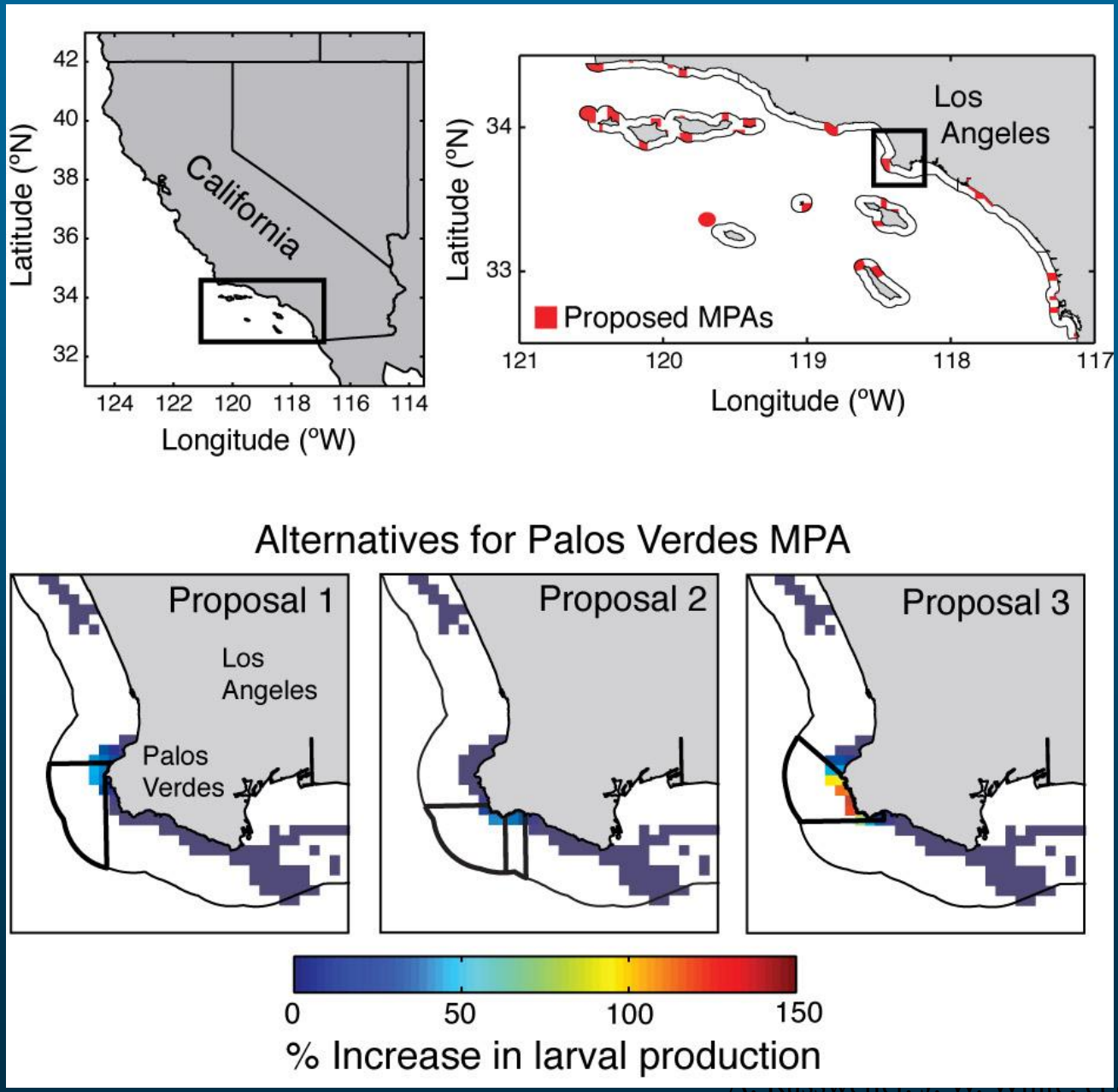
UCD Model Results: Fishery Yield



UCD Model Results: Biomass x Yield

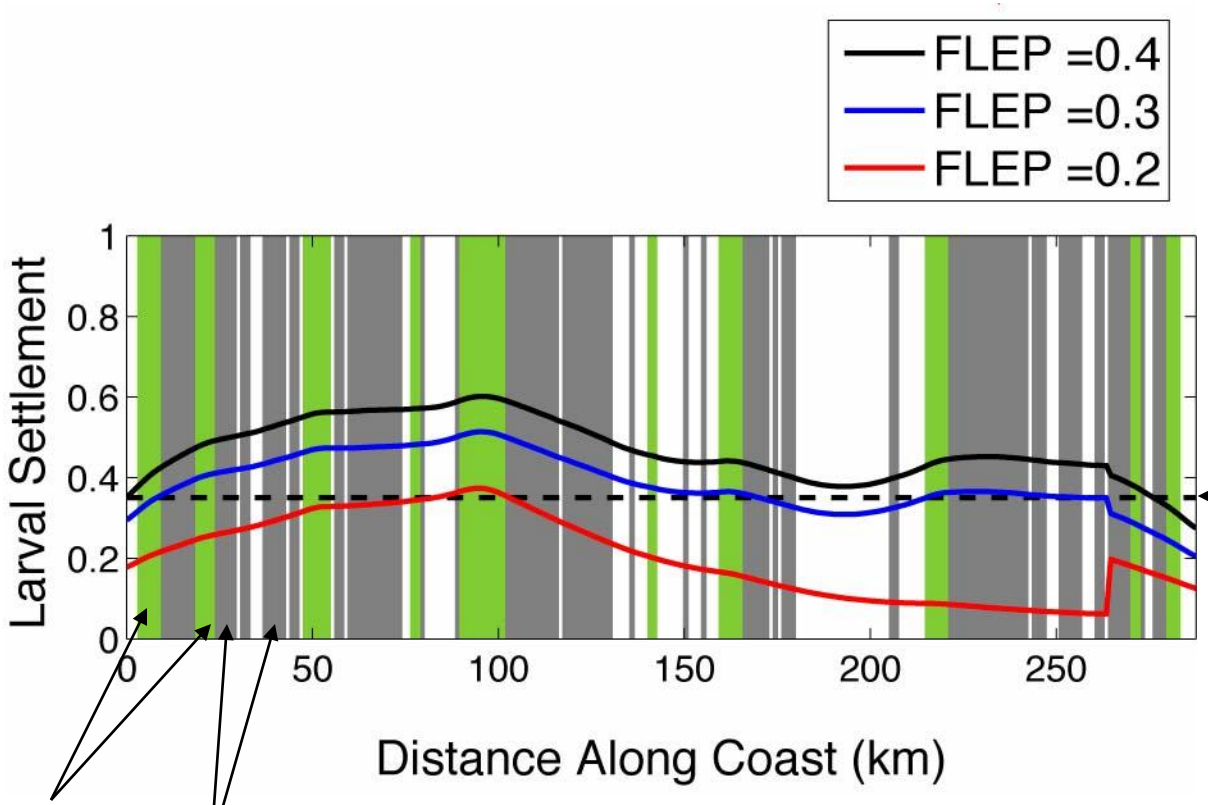


Compare alternatives for particular MPA



A. Rasmuson, J. W. White, et al. unpublished

Models of Population Sustainability for Proposed Networks
Results: Distribution of Settlement Along Coastline



Proportion of coastline above replacement threshold = "spatial sustainability"